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March 21, 2017

VIA ELECTRONIC FILING

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street S.W.
Washington D.C. 20554

Re: Oral *Ex Parte* Notice
GN Docket No. 14-177, IB Docket Nos. 15-256 and 97-95;
RM-11664 and 11773; and WT Docket No. 10-112

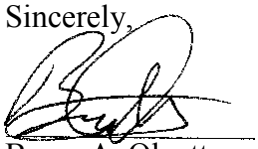
Dear Ms. Dortch:

On March 17, 2017, representatives of The Boeing Company ("Boeing") held a conference call with representatives of the Satellite Division of the FCC's International Bureau to discuss Boeing's technical analysis regarding the ability of its non-geostationary satellite orbit ("NGSO") fixed-satellite service ("FSS") system to operate in the 37.5-40.0 GHz band without causing harmful interference to the Upper Microwave Flexible Use Service ("UMFUS"). As indicated in the attached presentation, the discussion focused on Boeing's modeling of UMFUS receivers, which were assumed to potentially point in all directions, including toward the Boeing satellites.

Participating in the meeting on behalf of the Satellite Division were Jose Albuquerque, Diane Garfield, and Kal Krautkramer. Participating in the meeting on behalf of Boeing were Robert Vaughan, Robert Hawkins, Chris Foster, Alex Epshteyn, and the undersigned.

Thank you for your attention to this matter. Please contact the undersigned if you have any questions.

Sincerely,

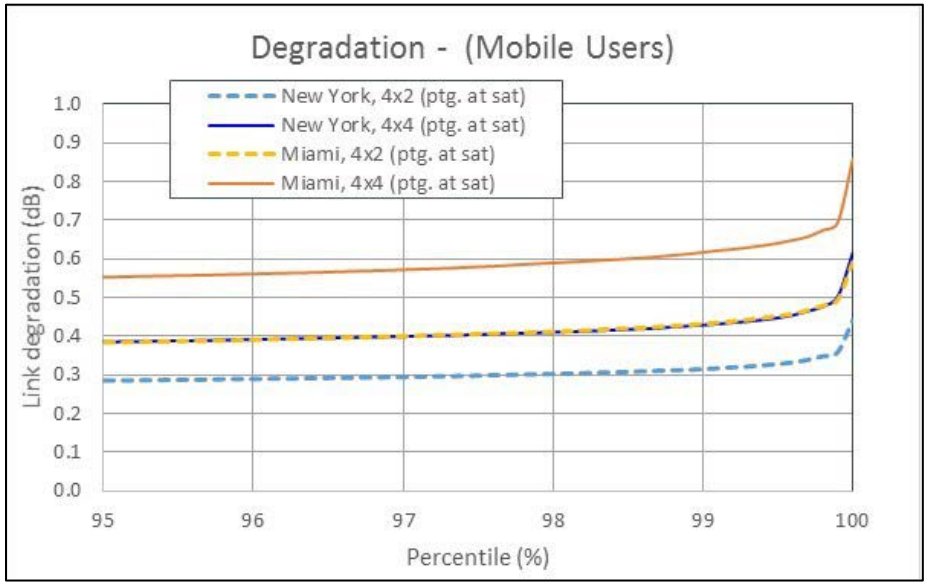


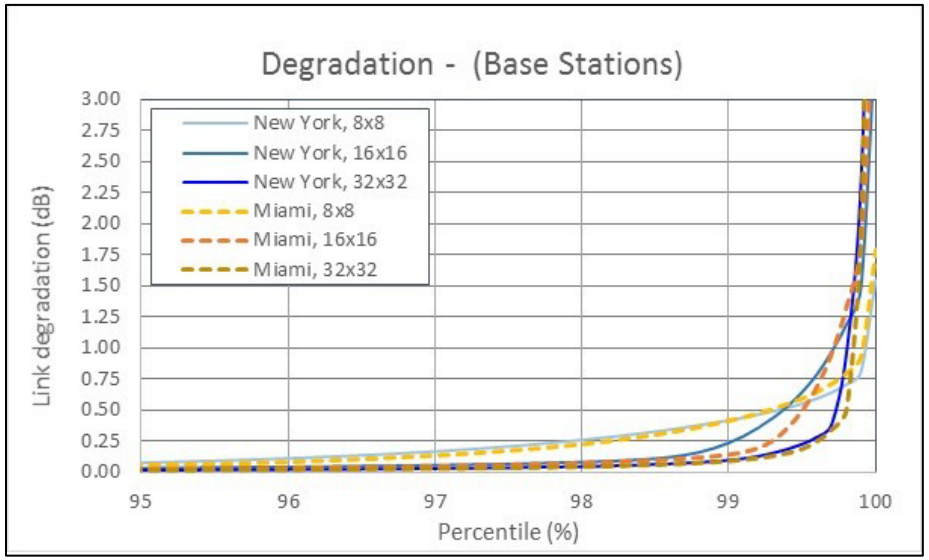
Bruce A. Olcott
Counsel to The Boeing Company

Spectrum Frontiers FNPRM
Discussion of V-band downlink spectrum sharing between NGSO FSS and UMFUS

17 March 2017

NGSO Operations in Worst-Case Rain Conditions has Negligible Impact on UMFUS





The beam pointing of the 5G user varies in each case 1, 2a/2b, 3a and 3b and was described in Boeing's FNPRM comments and in the following slide

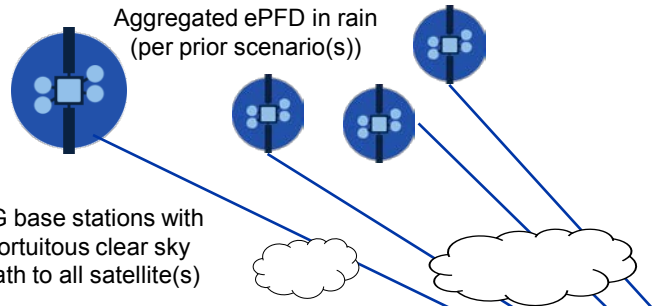
Scenario	5G receiver	Location	ePFD (dBW/m2/MHz)		Link degradation (noise increase), dB	
			99%	99.5%	99%	99.5%
1 – Mobile Users	Handset 4x2	New York	-108.1	-107.9	0.31	0.33
	Handset 4x4		-109.7	-109.5	0.43	0.45
1 – Mobile Users	Handset 4x2	Miami	-106.7	-106.5	0.43	0.45
	Handset 4x4		-108.1	-107.8	0.62	0.64
2a – Transportable CPE	CPE (8X8)	New York	-128.2	-127.5	0.020	0.022
2b – Transportable CPE	CPE (8x8)	Miami	-127.5	-126.7	0.022	0.026
3a - Base Stations (random ptg)	64 elem (8x8)	New York	-116.5	-115.0	0.42	0.55
	256 elem (16x16)		-125.1	-120.4	0.24	0.65
	1024 elem (32x32)		-135.0	-131.2	0.10	0.23
3a - Base Stations (random ptg)	64 elem (8x8)	Miami	-116.4	-115.0	0.42	0.60
	256 elem (16x16)		-127.0	-121.5	0.15	0.50
	1024 elem (32x32)		-135.2	-132.0	0.10	0.19
3b - Base Stations (Urban Micro)	64 elem (8x8)	New York	-129.3	-128.5	0.023	0.027
	256 elem (16x16)		-127.0	-136.0	0.016	0.018
	1024 elem (32x32)		-144.2	-143.2	0.012	0.014
3b - Base Stations (Urban Micro)	64 elem (8x8)	Miami	-129.0	-128.0	0.026	0.031
	256 elem (16x16)		-136.1	-135.5	0.018	0.022
	1024 elem (32x32)		-135.4	-142.6	0.014	0.017

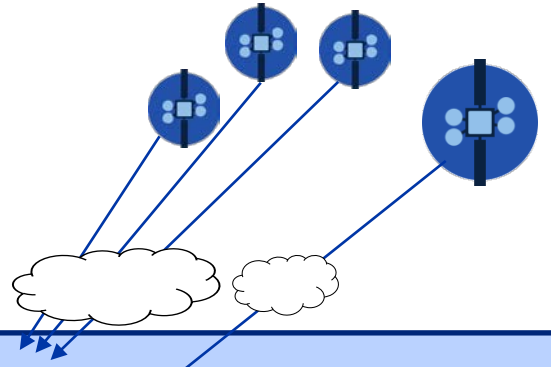
Impact to UMFUS is less than 0.65 dB in all cases with a 99.5% confidence level using improbable worst-case conditions – rain fade to satellite receivers and clear sky to UMFUS

Highly Representative UMFUS Receivers and Scenarios are Used in ePFD Analyses

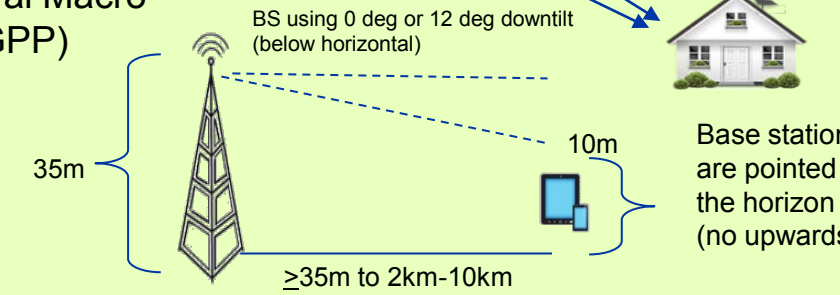
The beam pointing of the 5G user varies in each case and is annotated below

5G UMFUS Unit Type	Elements	Size	Peak Gain (dBi)	Noise Figure (dB)	EIRP Density (dBmi/100 MHz)
Base Station	64	8x8	21.1	5.0	75.0
Base Station	256	16x16	27.1	5.0	75.0
Base Station	1024	32x32	33.1	5.0	75.0
Transportable CPE	32	4x8	18.0	7.0	55.0
Transportable CPE	64	8x8	21.0	7.0	55.0
Mobile/Handset	8	4x2	13.0	7.0	43.0
Mobile/Handset	16	4x4	16.0	7.0	43.0





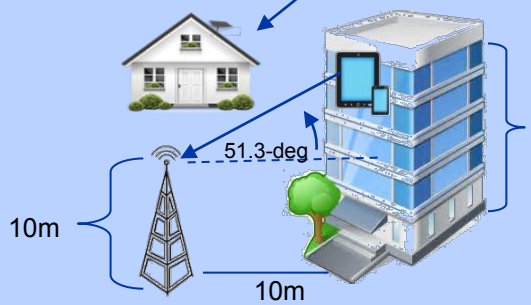
Rural Macro (3GPP)



Base station beams are pointed at or below the horizon (no upwards pointing)

Urban Micro (3GPP)

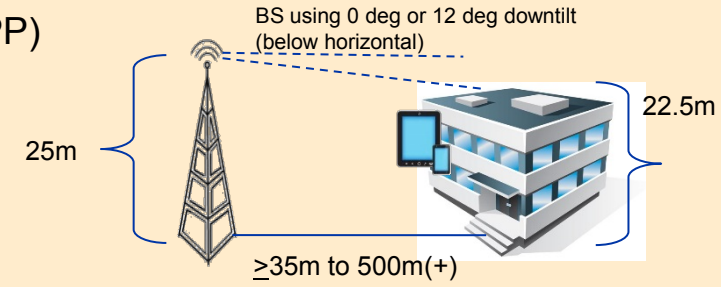
Used for Case 3b



Mobile inside small building
Clear sky path between building and mobile

Random pointed or user pointed beams – upwards pointing to 60-deg

Urban Macro (3GPP)



Base station beams are pointed at or below the horizon (no upwards pointing)

Random pointed beams – no upwards pointing sectors

Used for Case 3a

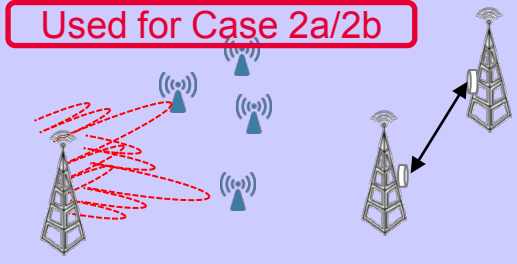
Mobile/Handsets

Used for Case 1

Random pointed beams – mispointed at a satellite

Transportables / CPE

Used for Case 2a/2b



Pointed at base station (UMi case)

Specific Pointing Conditions for FNPRM Cases

5G Antenna Pointing	Scenario	5G receiver	Location	ePFD (dBW/m2/MHz)		Link degradation (noise increase), dB	
				99%	99.50%	99%	99.50%
• Handset planar array boresight is physically rotated such that the boresight and the peak of beam is pointed at a satellite above the minimum elevation angle. • No electronic steering is applied	1 – Mobile Users	Handset 4x2	New York	-108.1	-107.9	0.31	0.33
		Handset 4x4		-109.7	-109.5	0.43	0.45
	1 – Mobile Users	Handset 4x2	Miami	-106.7	-106.5	0.43	0.45
		Handset 4x4		-108.1	-107.8	0.62	0.64
• CPE planar array is oriented at horizon (0-deg tilt) • CPE beam is electronically steered towards BS. • Geometry of BS and CPE is Urban Micro (UMi) (10m BS height, 0-22.5m uniformly distributed CPE height) • UMi cell size ISD=200m	2a – Transportable CPE	CPE (8X8)	New York	-128.2	-127.5	0.02	0.022
	2b – Transportable CPE	CPE (8x8)	Miami	-127.5	-126.7	0.022	0.026
• BS sector planar array physical boresight is oriented at horizon (0-deg tilt). • BS beam is uniformly randomly electrically scanned within +/-60-deg off-boresight.	3a - Base Stations (random ptg)	64 elem (8x8)	New York	-116.5	-115	0.42	0.55
		256 elem (16x16)		-125.1	-120.4	0.24	0.65
		1024 elem (32x32)		-135	-131.2	0.1	0.23
	3a - Base Stations (random ptg)	64 elem (8x8)	Miami	-116.4	-115	0.42	0.6
		256 elem (16x16)		-127	-121.5	0.15	0.5
		1024 elem (32x32)		-135.2	-132	0.1	0.19
• BS sector planar array physical boresight is oriented at horizon (0-deg tilt). • BS beam is electrically scanned to point at a user • Geometry of BS and Handset users is Urban Micro (UMi) (10m BS height, 0-22.5m uniformly distributed user handset height) • UMi cell size ISD=200m	3b - Base Stations (Urban Micro)	64 elem (8x8)	New York	-129.3	-128.5	0.023	0.027
		256 elem (16x16)		-127	-136	0.016	0.018
		1024 elem (32x32)		-144.2	-143.2	0.012	0.014
	3b - Base Stations (Urban Micro)	64 elem (8x8)	Miami	-129	-128	0.026	0.031
		256 elem (16x16)		-136.1	-135.5	0.018	0.022
		1024 elem (32x32)		-135.4	-142.6	0.014	0.017